

**Before the  
Federal Communications Commission  
Washington, D.C. 20554**

In the Matter of	)	
Expanding the Economic and Innovation	)	Docket No. 12-268
Opportunities of Spectrum Through	)	
Incentive Auctions	)	
	)	
Unlicensed Operation in the TV Broadcast	)	Docket No. 04-186
Bands	)	
	)	
Additional Spectrum for Unlicensed	)	
Devices Below 900 MHz	)	Docket No. 02-380
and in the 3 GHz Band	)	

**COMMENTS OF  
SPECTRUM BRIDGE, INC.**

**Executive Summary**

Spectrum Bridge, Inc. (“Spectrum Bridge”) applauds the FCC’s goal to develop rules for more flexible and efficient use of the VHF and UHF TV bands on a shared basis that will promote increased use of the band for new broadband services, while ensuring that Broadcast Licenses do not experience harmful interference. Further promoting innovation in this band will result in new technologies and more competitive offerings for the American Public. The proposed Incentive Auction process is complex and there remain questions and important issues that Spectrum Bridge addresses in the following comments. We do so from experience acquired over many years of providing a secondary market place for spectrum, providing spectrum sharing databases (5GHz and VHF/UHF TV White Space), and providing Spectrum Management and Spectrum Planning services to the wireless industry.

Specifically we question whether the proposed FDD channel clearing structure is the most efficient or effective method of clearing, given the desire to support more broadband data services. Or whether this structure will lead to the most attractive and therefore financially beneficial Auction.

We strongly advise the continued use of a geo-location database to manage the shared access and to promote the use of unlicensed spectrum during and after a protracted transition period. Such that cleared and reallocated spectrum should remain “white space” until it is actually put to use for licensed services (use it or share it).

The impact of shoehorning LPTV into the revised bands requires further attention. Currently, there are roughly twice as many LPTV licenses as high power broadcast licenses. While some of the LPTV licenses provide valuable local service and some are providing innovative new services, many appear to be offering minimal service to simply comply with their license requirements.

Repacking of TV licenses is complex and impacts much more than just broadcast services. The current sharing of licensed and unlicensed microphones has identified a number of issues and inefficiencies that we seek to resolve.

/s/ Peter Stanforth

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## Most efficient and effective use of TV Spectrum

The FCC Cites its own policy of flexible rules to promote the most efficient use of spectrum<sup>1</sup> but the sole proposal in the NPRM is for spectrum “pairing”. It is not clear that this strategy is in the best public interest even though the NPRM states, “Our central goals are to repurpose the maximum amount of UHF band spectrum for flexible licensed and unlicensed use in order to unleash investment and innovation, benefit consumers, drive economic growth, and enhance our global competitiveness”<sup>2</sup>.

This paired spectrum approach<sup>3</sup> is neither the best nor only option for the use of this spectrum and serious consideration should be given to an alternate auction approach that provides unpaired access. This has significant implications for the proposed band plans.

When symmetric/paired spectrum is allocated, the maximum achievable data transfer is limited to half the available bandwidth/spectrum – in both directions. Whereas if a single unpaired band plan was adopted, the maximum data transfer could be 100% in either direction. Given the nature of data traffic – which is generally agreed to be driving wireless demand - a TDD plan<sup>4</sup> would be much more efficient and effective use of this spectrum than a band plan that has its roots in legacy 2-way voice telephony applications. Total bandwidth in a single 20MHz channel will exceed the total bandwidth of 2x10MHz channels. Currently available

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<sup>1</sup> FCC 12-118, paragraph 23 *“The Commission’s approach has evolved over time toward the adoption of*

*2*FCC 12-118, paragraph 10

*3*FCC 12-118, paragraph 125 & paragraph 126

*4*FCC 12-118, paragraph 183

wireless technologies such as IEEE 802.11 and TD-LTE demonstrate the capability and effectiveness of TDD, including low cost and QOS focused implementations. There are many examples of unlicensed use of this spectrum that are not possible with a traditional FDD/cellular band plan. These applications are successful because of the ability to dynamically vary the uplink and downlink capacity.

One further argument for creating TDD bands is that the bands and devices will be more compatible with white space devices and the potential for leveraging innovation, flexible use, economies of scale, and sharing.

There is another weakness in the traditional auction process. It favors certain user groups over others and therefor reduces completion and the value obtained. This is because the geographic makeup of licenses favors a wide area service provider use case<sup>5</sup>. Our experience in the secondary markets for spectrum has shown us that many industrial and commercial use cases are not congruent with such a structure. Much of what we do in facilitating secondary markets is to partition those licenses, or “stitch together” pieces of multiple licenses so that the coverage area is consistent with the service requirements of the enterprise or commercial user. A real time leasing auction in which spectrum is made available in small enough blocks would allow these types of entities to bid on spectrum and significantly increase the bidding pool and the potential value to the treasury and meet the auction requirements of the Middle Class Tax Relief and Job Creation Act. Alternatively,

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<sup>5</sup>FCC 12-118, paragraph 144 “Geographic Area Licensing

an auction process that relies on much smaller geographic “parcels” may have a similar effect of attracting more bidders.

### **Use of remaining spectrum for unlicensed use**

The NPRM states that remaining unused spectrum will be treated as white space and available for unlicensed use. Spectrum Bridge suggests that this statement should be more definitive with respect to the definition of ‘unused’. Our experience has shown that a significant amount of spectrum is licensed but not being used. This is evident by the number of TV station licenses for sale at any given time on the secondary market or which are simply maintained by marginal compliance with the rules. The secondary market also includes a number of un-built rural cellular licenses. Therefore, the simple act of repacking and auctioning the VHF and UHF spectrum should not be sufficient in removing it from the pool of white space. The spectrum should only be removed once it has been demonstrated that it is actively being used for the intended purpose (Use it or Share it). It could take years for rural build out of auctioned spectrum to occur and it does not have to remain fallow during that period if white space rules are applied and managed by a database.

A Database solution can, and should be, the mechanism for managing unlicensed access to TV spectrum post transition. The following examples illustrate innovative use of the spectrum that are valuable to the community and support the fact that sufficient white space should be preserved to allow these applications to continue to

thrive. It should be noted that many of these applications are impractical or uneconomical to operate on a commercial cellular data network.

**White Space for Agriculture, Forestry and Mining.** We see many examples of unlicensed white space solutions being used to automate farming and similar applications. Such applications are spread over wide areas and typically do not have Line Of Sight (LOS) connections to a control center. TV White Space enables Non Line Of Sight (NLOS) capability that cannot be accomplished with higher frequency, unlicensed spectrum.

**Micro Broadcast, Digital Signage and content delivery.** When broadband streams such as video are in demand by a large number of devices, broadcast technology remains as the most efficient method of delivery. Above and beyond the services offered by licensed broadcast services, there are a number of innovative and valuable services being offered using VHF/UHF white space.

**Wireless electronics.** With the advent of IEEE 802.11ac, the technology industry is well on the way to being able to remove most of the wired connections that run through offices and homes. Today IEEE 802.11ac operates in the 5GHz band which has very limited propagation capability. To fully exploit the concept, the device manufacturers need to know that they can achieve whole house or whole office coverage. The IEEE 802.11af standard, which maps the technology and protocols in to the UHF TV Spectrum, achieves this goal by exploiting the significantly better propagation characteristics of the UHF TV spectrum.

## **Low Power TV Stations**

Low Power TV Stations (LPTV) are precluded from the auction process but also have limited or no protection as a result<sup>6</sup>. LPTV comprise almost 66% of the stations that are protected by the White Space database (6500 out of 1120)<sup>7</sup>. While many of these stations may have no intention to move to digital operation, some provide very valuable service to their local communities, particularly those communities not served by main stream broadcast solutions. Spectrum Bridge would encourage the FCC to both strictly enforce the LPTV rules to flush out those that are providing marginal service to simply protect a broadcast right, or not broadcasting at all, while finding a way to ensure that those LPTV stations that are legitimate and providing a public good and public value are protected. Furthermore, we would ask the FCC encourage these low power services to demonstrate a need for a dedicated 6MHz channel, as opposed to sharing a sub multiplex of a high power station or a group of low power services in a single 6MHz multiplex. To the extent that ways may be found to encourage the sharing of channels that make financially marginal stations viable.

## **Impact of repacking on Program Making and Special Event systems (PMSE)**

In general PMSE covers wireless microphones and similar wireless control systems used in program making and special events. Today the White Space Database provides protection for licensed users based on current FCC rules. These solutions

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<sup>6</sup>FCC 12-118, Section IV paragraph 74

<sup>7</sup>See daily audit reports from Spectrum Bridge's TV White Space Database system [www.spectrumbridge.com](http://www.spectrumbridge.com)

use the unused TV channels at a location and sometimes operate as a secondary underlay to the TV broadcast channels. In some cases PMSE systems may need to be replaced if they can only operate in the portions of the bands that are auctioned. The second set of PMSE solutions have been classified as unlicensed and these are expected to share the unoccupied channels with unlicensed white space devices. Experiments have validated that these systems can co-exist except when they are in very close proximity (1-2 meters)<sup>8</sup>. White Space Database tools already exist to guide the unlicensed microphone users to favorable channels. If the UHF spectrum is to be realigned, unlicensed microphones should be treated like any other unlicensed device operating in the guard bands or unused TV spectrum and leverage the database intelligence to enable the PMSE user to identify the optimum spectrum to operate within.

Wireless microphones are over protected when they are allocated a full 6 MHz TV channel. Wireless microphones should not be allocated more than 200 KHz and the industry should be encouraged to use available technologies to reduce this to 50KHz.

The two (2) reserved channels, along with the channels that are effectively off limits to white space devices results in many urban areas in which there are 5 or more channels reserved for microphones, yet few if any available for white space devices. Further interaction with microphone users has shown that the reserved channels are often useless to the user, based on the actual frequencies that their equipment can utilize. Spectrum Bridge proposes that the FCC improve on the rules related to

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<sup>8</sup>Technical Reports from the Cambridge White Space Trial and Nokia reports from Theatre testing in Helsinki



the reservation of channels such that these channels are not always off limits to white space devices. Priority should be given to wireless microphones but when these channels are unoccupied they should be available for white space devices. Spectrum Bridge further proposes that the protection of all wireless microphones could be much more effectively accomplished if the reservations were managed by the database systems. Channel selection by the database would ensure the most efficient allocation as the database can enable co-existence.

A significant number of wireless microphones are used co-channel and the FCC should consider more flexible rules for co-channel use as this is already a common practice.

## **Other Comments**

### **T-Band Licenses**

The NPRM identifies that T-Band licenses are operating in the UHF TV band but does not address them<sup>9</sup>. However the NPRM does identify that over a number of years these services will migrate out of the UHF band. The continued use of a White Space Database will enable the use of these systems to be tracked such that the Database can manage the availability of that spectrum in locations where T-band systems have migrated.

### **Impact on Radio Astronomy in Channel 37 (608-614MHz)**

The existing TV White Space database can handle the management of these facilities with regard to protection from white space devices. The existing facilities are known and conservatively protected today (the entire channel is off limits), yet a

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<sup>9</sup>FCC 12-118, paragraph 19

database could permit use when adequate protection has been afforded. Spectrum Bridge would also suggest that a mechanism similar to the approach used in the 3.65 GHz band. Should a White Space network deployment be desired within the defined protected area (which could be easily identified using database tools), the operator would be required to seek permission from the Radio Astronomy community. If it can be satisfactorily demonstrated that such a deployment will not cause harmful interference it should be permitted. relocates to another band.

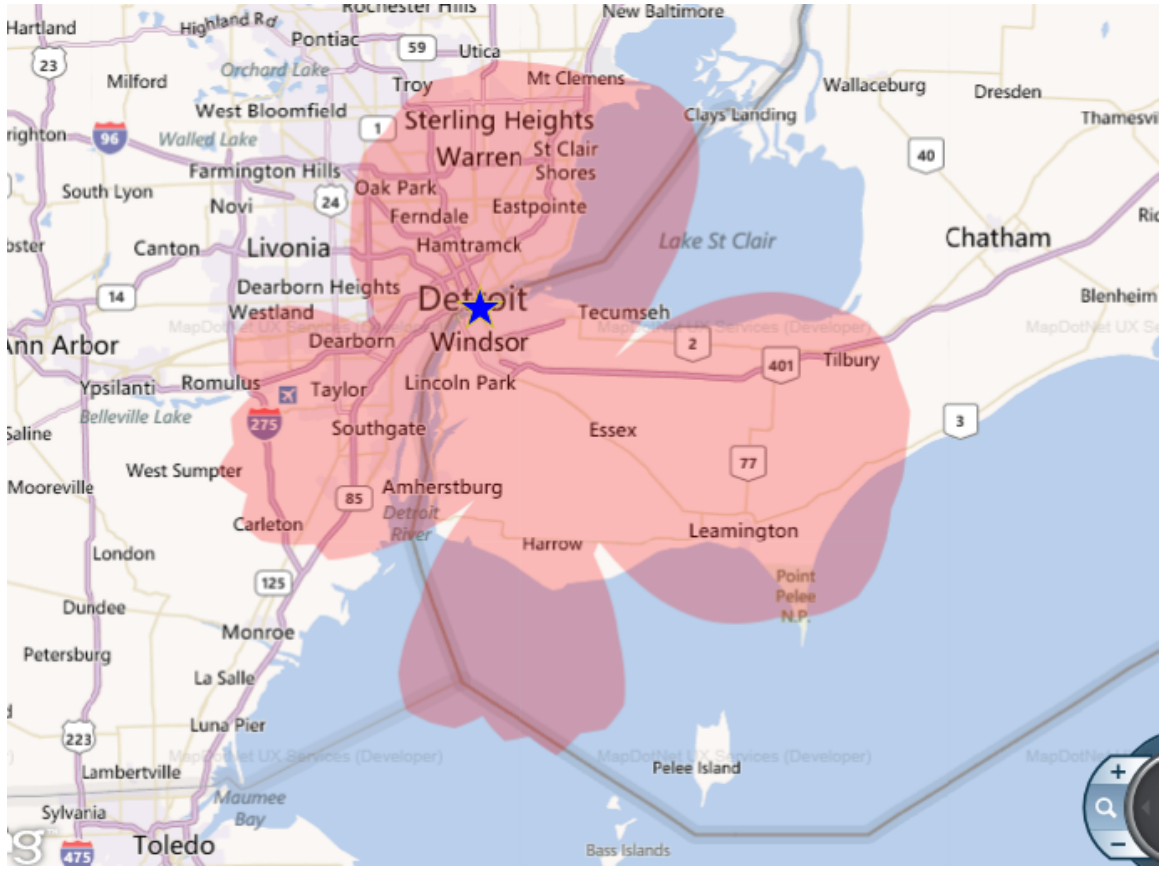
#### **Canadian and Mexican TV Station impact.**

The proposed band plan assumes clearing of US TV stations, but stations just over the border in Canada and Mexico have a potential impact, both on the practical use of the spectrum in the USA, as well as possible cross border interference into Canada and Mexico<sup>10</sup>.

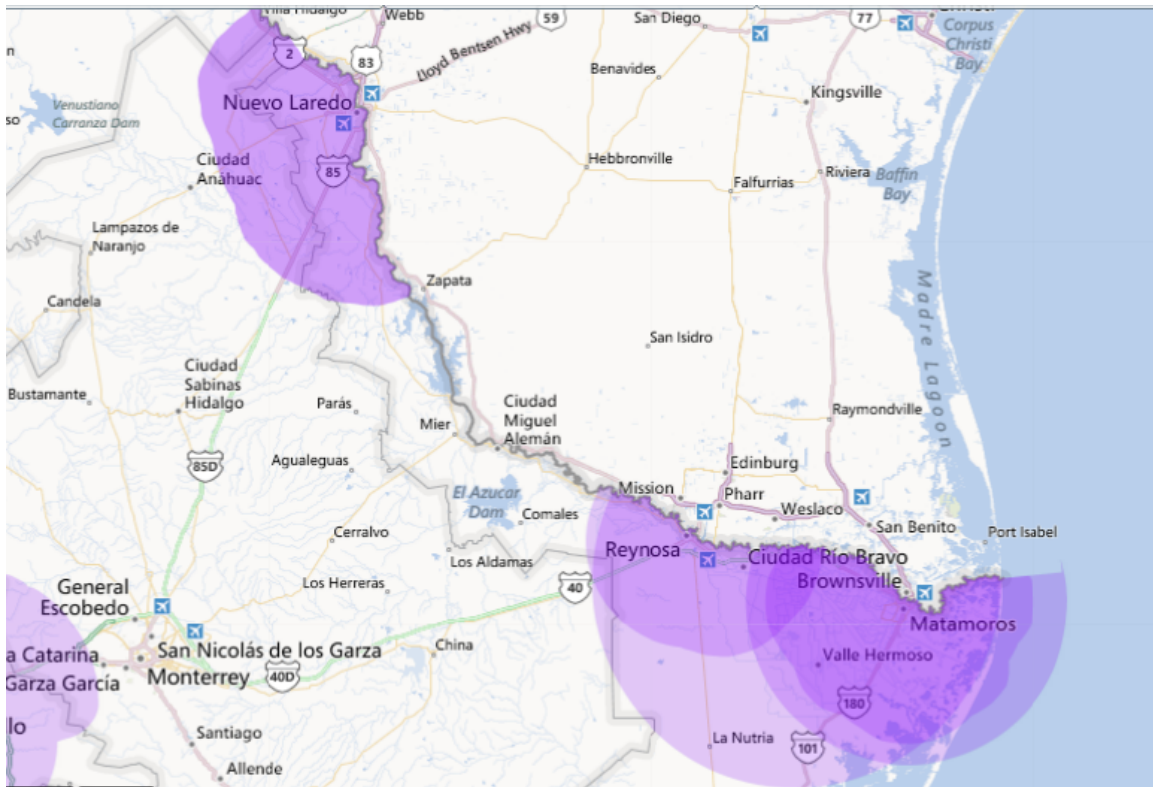
The following Figure shows the cross border impact of a Canadian station operating on Channel 35:

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<sup>10</sup>FCC 12-118, paragraph 197



The following Figure shows the cross border impact of Mexican Stations on the US border. In this case, channel 51. Note they are truncated at the border as a function of White Space rules but the broadcast clearly does not stop at the border.



### Use of Geo-location databases

The database solutions already adequately manage existing incumbent licenses. The NPRM suggests the potential for a guard band that varies based on location. The database can map these guard bands and assign access in a similar way to the current way TV channels are allocated. The database also provides a highly flexible mechanism for dealing with the volatility of a transition and an easy way to modify and manage allocations in the future.

Spectrum Bridge requests that the FCC not limit the definition/regulation of sharing to simply a database management system. Spectrum Bridge believes that the unused spectrum in the TV band would be much more effectively and efficiently used by unlicensed devices, wireless microphones and others, if the current

database solutions were to evolve into solutions that also leverage the intelligence in the radios - the ability to more accurately determine position, the context of what the device is doing, or sensing the RF environment nearby. All these capabilities, when integrated with the geo-location database, improve the chance of interference avoidance and enable more successful co-existence.

### **Guard Bands and Use by unlicensed white space devices**

White space devices are currently being deployed based on a 6MHz TV channel.

Guard bands need to be 6MHz as a minimum to allow deployed TVBDs to continue to operate. Should Guard bands be flexible beyond the 6MHz minimum, the databases will be able to make that spectrum available and useful to new unlicensed devices that can accommodate a wider channel. Note that TV White Space devices will likely be able to use up to 8 MHz channels, as manufacturers develop products for worldwide markets where many TV Standards define operation in 8 MHz channels. Current 802.11af standards, for example, will support such varied channel sizes.